Section XIII
Patient Projection Analysis

During prior years' ELDAs, patient projections were not included as a component of the VA Enrollee Health Care Projection Model. Unique patients for each Fiscal Year were projected separately, after the completion of the modeling process. It was difficult and time-consuming to generate patient projections for alternate scenarios, and the projections were not readily adaptable to certain scenario modeling.

The task for the FY04 VA Enrollee Health Care Projection Model was to:

- Review the prior methodology.
- Update the methodology based on more recent and comprehensive patient data.
- Incorporate the methodology into the VA Enrollee Health Care Projection Model so that patients are readily available as an output from the model.

Conditions for success of this task were:

- Improved quality of patient projections
- Increased efficiency in generating patient projections

A patient is defined as an enrolled veteran who receives any health care service from VHA during a particular fiscal year, including fee-based care. Nursing home care is excluded, as a complete list of veteran nursing home patients from state nursing homes is not available. In addition, health care services not considered in the VA Enrollee Health Care Projection Model, such as Dental and Chaplain services, were not included in the patient analysis.

It is important to recognize that a count of unique patients is not a particularly meaningful measurement of expenses or of services provided. First, all patients are counted the same, regardless of intensity of services. Thus, a patient using VHA only to have a single prescription filled is counted the same, under this measure, as a patient receiving extensive medical treatment in an inpatient setting. Second, all enrolled veterans are actual beneficiaries of VHA, even if they do not receive any health care services during a particular year. The existence of a VHA safety net in addition to the enrollees' other insurance is a benefit to every enrolled veteran, regardless of reliance. Although every effort has been made to provide reasonable and accurate

projections of patient counts, these projections are not intended to form the basis for decision-making or reporting. Measures of exposure (Average Enrollment) and liability (Utilization and Expenditures) are more accurate for decision-making and reporting.

Improvements to Model Efficiency

The methodology used to project patients for previous ELDAs required several model runs after a final ELDA baseline model had been selected. These scenarios were used to estimate parameters that were in turn applied to projections of unique enrollment in order to arrive at estimated patients.

In order to improve the efficiency of the patient model, certain changes had to be made:

1. Unique enrollment had to be added as an input to the VA Enrollee Health Care Projection Model.
2. Parameters of the patient model had to be expressed as a function of values available within the VA Enrollee Health Care Projection Model.

The first change was made in conjunction with other changes to make reporting on the utilization and expenditure projections more user-friendly. In these changes, several enrollment statistics, such as fiscal year unique enrollment, beginning enrollment, and year-end enrollment, were passed through the VA Enrollee Health Care Projection Model and made available in the Utilization and Cost Projection databases so that they could easily be provided in the Report Writer.

The remainder of this section is devoted to the second change: Creating a Patient Projection Model.

Model Parameter Selection

Parameters for the patient projection model were selected prior to analysis of recent patient data. Parameters were selected based on perceived likelihood of correlation with patient frequency. As the selected parameters produced a very good model during the estimation and testing phase, no effort was made to search for other possible parameters.

The parameters selected were:

- Age (in 5-year age bands)
- Priority Level
- Enrollee Type
- Reliance
- Morbidity

There is not just a single estimate of Reliance or Morbidity for any enrollee or group of enrollees. (Rather, the morbidity and reliance factors vary by type of service provided.) Since approximately 90% of all VHA patients received "Office Visit" services during FY 2002, it was surmised that the Reliance and Morbidity factors used in the Office Visit projections were the factors most representative of patient frequencies.

After controlling for the other parameters, it was determined that regional variations in Morbidity were not significantly correlated with regional variations in patient frequency for veteran enrollees under the age of 65. Otherwise, all of the parameters listed above, were considered significant, and sufficient to create a robust model.

Model Parameter Estimation

For fiscal years 2001 and 2002, a database of unique enrollees and unique patients was summarized by Priority Level, Enrollee Type, 5-year Age Band and Submarket. Appropriate Office Visit Reliance factors and Outpatient non-Mental Health Morbidity factors were attached. The FY 2002 enrollee and patient data was used to select and fit the model. The FY 2001 data was used to test the model.

A logistic regression model was chosen to estimate patient frequency.[1] The particular advantage of logistic regression over simple linear regression is that logistic regression only predicts values between 0 and 1 and thus is commonly used for models of binary events.

P = Unique Patients / Unique Enrollment

$\text{Logit}(P) = \text{LN}[P/(1-P)]$

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[1] Details about the logistic regression can be found in many references including: The SAS System documentation for PROC LOGISTIC; *Analysis of Variance, Design and Regression* by Ronald Christensen; and *The Statistical Sleuth* by Ramsey and Schafer.

The selected regression fit the following equations:

$$\text{Logit}(P) = A + B * \text{Morbidity} + C * \text{Reliance}$$

Where *A* varies by Age Band, Priority Level and Enrollee Type, and *B* and *C* vary by Age Band. *B* and *C* only vary by Age Band in the selected regression, because Morbidity and Reliance factors already vary by Priority Level and Enrollee Type. (They also vary between major age groups, but Age Bands are more detailed). Effectively, *A* captures the overall tendency to be a patient for each Age Band, Priority Level and Enrollee Type. *B* and *C* primarily capture the impact of regional variations in Morbidity and Reliance. Because of the small number of enrolled veterans in Priority Levels 6 and 7a, Priority Level 7a was grouped with Priority Level 3 and Priority Level 6 was combined with Priority Level 7c. These combinations were determined based on similarities in patient frequencies.

Model Verification and Testing

Predicted Patient frequencies are then calculated using the inverse of the Logistic function.

$$\text{Logit}(P) = A + B * \text{Morbidity} + C * \text{Reliance}$$
$$P = \text{Exp}[\text{Logit}(P)] / \{1 + \text{Exp}[\text{Logit}(P)]\}$$

Predicted Patient frequencies calculated using FY 2002 Actual Patient frequencies were computed for FY 2002 and FY 2001. The results are evaluated for error variance, and predictive validity. In FY 2002 and FY 2001, the selected model explains, respectively, 83.3% and 83.1% of the variation in patient frequency. Also, in FY 2001, the selected model predicted a total number of patients that was 98.6% of the actual total.[2]

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[2] References:

1. Analysis of Variance, Design and Regression: Applied Statistical Methods. Ronald Christensen. 249-252.

2. The Statistical Sleuth: A Course in Methods of Data Analysis. Ramsey and Schafer. 564-631.